CANON ENVIROTHON
SOILS & LANDUSE STUDY GUIDE

Introduction

Soil is a basic natural resource used by humans to meet one or more of their needs. It provides raw materials, stores water and nutrients, and supports growing plants that produce food and fiber. It also provides space for cities, highways, recreation, and wildlife. Nothing surrounds us more in our daily lives. But, like so many things important to life, soil goes unnoticed until we learn to appreciate it.

The land resource is limited in quantity and its quality. It varies from place to place as a result of the interactions of climate and vegetation on geological materials as conditioned by topography over a period of time. Even small changes in any one of the soil forming factors can create a different soil. It is no wonder that so many kinds of soils exist with different profile features and properties. Soils vary in the kind, number, and degree of development of major horizons and sub-horizons that may form. Few soils have all horizons, but all soils exhibit some of them.

Judging Land

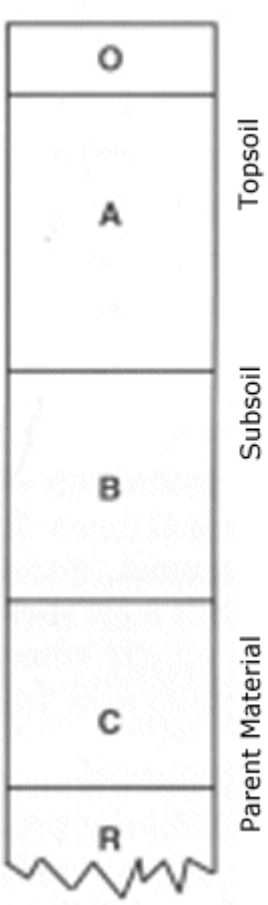
Land judging is a recently added judging event in the field of agriculture. Land can be judged much like animals or crops. In judging crops, we look at the size, shape, and quality and determine which is the best. Similarly, when judging land, we look for clues that tell us how well the land can produce crops or be used for other purposes. Soil characteristics, climate, and topography are good clues to the soil's capabilities, but close examination of the soil texture, structure, depth, permeability, reaction, degree of erosion, slope, drainage, and flooding potential are necessary to classify land into capability classes. In land judging, the major factors affecting how the land can be used must be determined. These factors are used to correctly recommend conservation practices and fertilizers for conserving soil.

Land judging can help to:

- Understand basic soil differences.
- Know how soil properties affect crop growth.
- Know why soils respond differently to management practices.
- Realize the influence of land features on production and land protection.
- Select suitable soil and water conservation practices.
- Determine land capability class.
- Determine proper use and treatment.

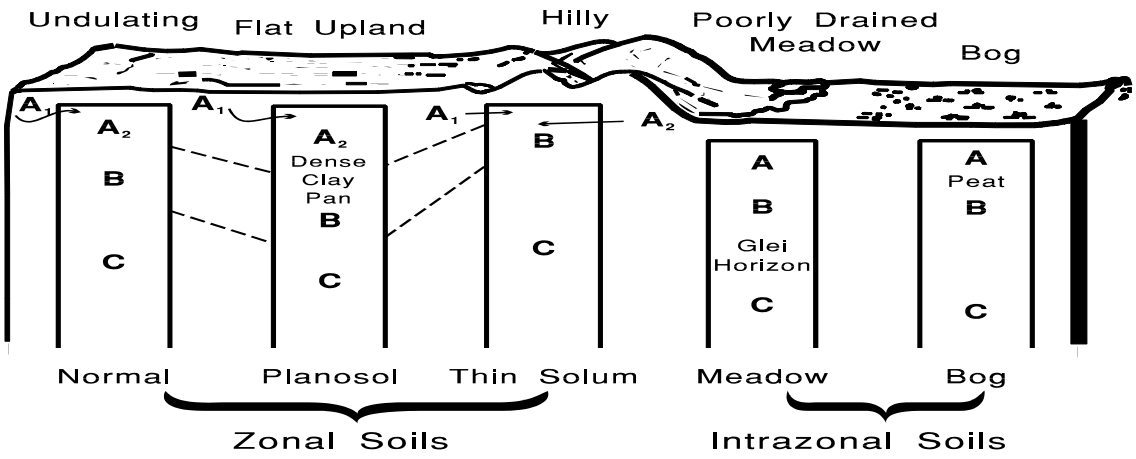
Soil Profile

The term "soil profile" is an important concept to learn. Soil profile is a side view or vertical cross-section of the soil as seen in a ditch bank or dug pit that allows the topsoil and subsoil to be examined. When we look beneath the surface of the soil, we see that the soil is divided into layers or "horizons." These layers differ in color, physical properties, chemical composition, and biological characteristics. This is the soil profile. It has three major parts or horizons: (1) the topsoil or "A" horizon, (2) the subsoil or "B" horizon, (3) the parent material or "C" horizon. A hypothetical soil profile is shown in Figure 1. Most land judging decisions are based on a soil profile that is at least 40 inches deep.



O-Organic horizon of undecomposed and decomposed organic matter. Absent in cultivated and many other soils.
A-Mineral surface soil which has accumulated decomposed organic matter and is usually darker colored than lower layers. It is also the horizon that has lost organic matter, clay, iron, and aluminum due to downward movement.
B-Mineral horizon that usually has a finer texture, or a darker, stronger, redder color and a distinctly different developed structure. Structure is often more distinct than in the "A" horizon.
C-Mineral horizon of weathered parent material like the material from which the soil developed or other substratum of unconsolidated material not related to the above soil.
R- Underlying consolidated bedrock. Absent under many soils.

Figure 1. Hypothetical soil profile showing the letter designation used in describing the major kinds of horizons usually present.

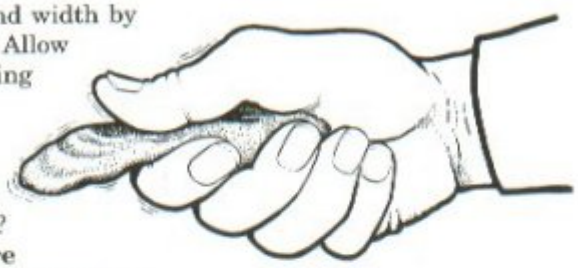


Topography is a major factor in soil development

Flow Diagram for Estimating Soil Texture by Feel

Start: Take approximately 1 tablespoon of soil and wet by adding water in small amounts. Knead to break down all aggregates until soil is plastic and moldable, like moist putty.

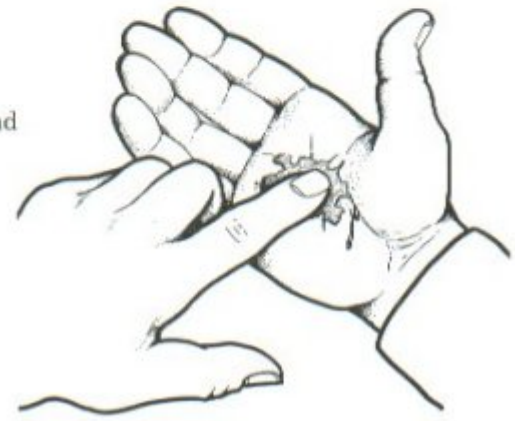
Step 1: Try to form a ribbon of uniform thickness and width by gently pushing the soil between thumb and forefinger. Allow the ribbon to emerge and extend over the finger, breaking from its own weight.



A: Soil does not ribbon — **coarse texture**

B: Soil does ribbon — What is the length of the ribbon?
- **B1:** If the ribbon is over 2 inches long: **fine texture**
- **B2:** If the ribbon is 1 to 2 inches long: **moderately fine texture**
- **B3:** If the ribbon is less than 1 inch long: **Go to Step 2**

Step 2: Excessively wet a small pinch of soil in your palm and rub with forefinger.



C: Is the soil gritty?
- **C1:** The soil is not gritty—**medium texture**
- **C2:** The soil is gritty—**moderately coarse texture**

Soil Factors

Texture

Soil texture refers to the relative proportion of sand, silt, and clay particles in a specific soil mass. It is easiest to determine when the soil is moist. Sand feels gritty when rubbed by the finger. Silt feels slick or velvety. Clay is usually sticky and plastic when wet and when pinched between the thumb and finger forms a flexible ribbon. The ***surface*** texture is normally determined from at least plow depth or 6 inches, however, erosion may have removed the surface to such an extent that only 1 or 2 inches may remain. For contests, a boxed sample of surface soil and subsoil will be provided to judge texture.

In soils, several subdivisions of texture are recognized and are illustrated below. For land judging we recognize five texture categories represented by the middle column of the accompanying table.

Texture Groups

Sandy Soils	Coarse	Sand
		Loamy sand
Loamy Soils	Moderately coarse	Sandy loam
		Fine sandy loam
	Medium	Very fine sandy loam
		Loam
		Silt loam
		Silt
	Moderately fine	Clay loam
		Sandy clay loam
		Silty clay loam
Clay Soils	Fine	Sandy clay
		Silty clay
		Clay

Coarse-textured soils are loose, very friable, and the individual grains can be readily seen or felt. When squeezed between thumb and forefinger, it feels gritty and will not ribbon or stain fingers. Squeezed when dry, it will fall apart as pressure is released. When moist, a mold may be formed which is unstable and crumbles as the soil is handled.

Moderately coarse-textured soils feel gritty but contain enough silt and clay to make moist soil hold together. The individual sand grains can readily be seen and felt. Squeezed when dry, it will form a mold which breaks readily upon handling. If squeezed when moist, a mold can be formed which can be carefully handled without breaking. It forms no ribbon or very poor ribbon.

Medium-textured soils have a slightly smooth or velvety feel when moist. Squeezed when dry, it forms a mold that will bear careful handling. The mold formed by squeezing when moist can be handled freely, without breaking. When the moistened soil is squeezed out between thumb and forefinger, it will form a poor ribbon with a dull surface.

Moderately fine-textured soils usually break into clods or lumps when dry. When the moist soil is squeezed out between thumb and forefinger, it crushes with some effort. It will form a short (1 inch to 2 inch) well-formed ribbon with a shiny surface which will tend to break or the ribbon will bend downward. The sandy clay loam texture has a slightly gritty feel when moist.

Fine-textured soils form very hard, massive lumps or clods when dry and are quite plastic and sticky when wet. When the moist soil is squeezed out between thumb and forefinger it crushes with considerable effort and will form a long (2 inch+) ribbon which will support itself. The sandy clay texture may also have a slightly gritty feel when moist.

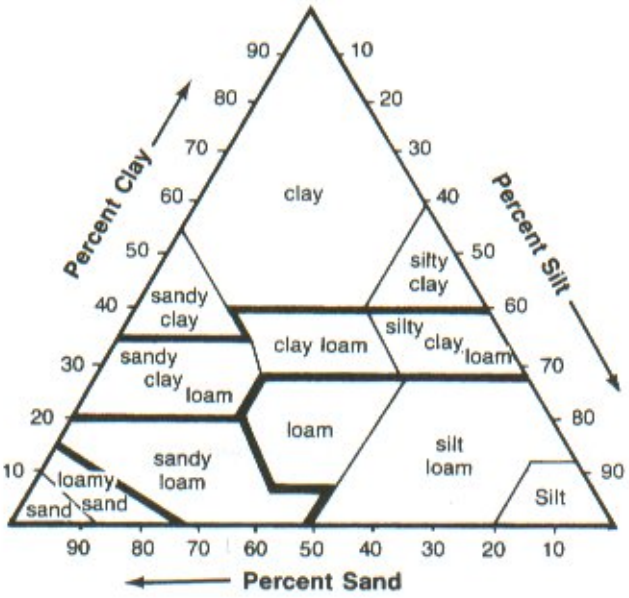


Figure 2. Soil textural classes shown in five different categories.

Soil Depth

Depth refers to the total thickness of the surface and subsoil plus any underlying material that is favorable for root development. Soils are categorized into several different soil depths. Depth is an important factor of soils. It determines the total amount of water held in the soil, the volume of soil available for plant root growth, and the supply of nutrients available to plants. Generally this material is underlain by bedrock, clay, or shale beds, or alluvial material.

Deep soils have over 40 inches of soil that can be penetrated by plant roots.
Moderately deep soils have over 20 inches of soil but less than 40 inches of soil that can be penetrated by plant roots.
Shallow soils have over 10 inches but less than 20 inches of soil that can be penetrated by plant roots.
Very shallow soils have less than 10 inches of soil that can be penetrated by plant roots.

Soil Slope

Slope has a tremendous effect on water runoff, erosion, and use of farm machinery. It is expressed as a percent, and is defined as the number of feet that the land rises or falls in a 100-foot horizontal distance. For example, a slope between two points which are 100 feet apart with a difference in elevation of 5 feet would have a 5% slope (Figure 3).

Nearly level --- Land with less that 1 foot elevation change in 100 feet.
Gently sloping --- Land with 1 to 3 feet elevation change in 100 feet.
Moderately sloping --- Land with 3 to 5 feet elevation change in 100 feet.
Strongly sloping --- Land with 5 to 8 feet elevation change in 100 feet.
Steep --- Land with 8 to 15 feet elevation change in 100 feet.
Very Steep --- Land with over 15 feet elevation change in 100 feet.

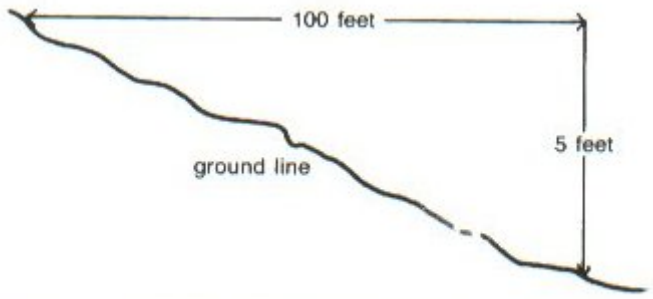


Figure 3. Diagram showing a 5 percent slope.

Erosion

Soil erosion is the detachment and movement of soil materials by wind or water. Erosion consists of three distinct processes -- detachment, transport, and deposition. Raindrops falling on unprotected soil, wind striking unprotected soil particles, and the bombarding action of moving particles are detachment forces. Flowing water and air currents are the transportation forces. Four erosion classes are recognized in land judging.

None to slight --- Soils of this class show no obvious effect of erosion. The plow layer exhibits characteristics of the "A" horizon. Less than 25 percent of the surface soil has been removed and no gullies are present.

Moderate --- Soils of this class have 25 to 75 percent of the original surface layer present. The plow layer may consist of a mixture of the surface "A" horizon and underlying "B" horizon. Small rills and occasional, crossable gullies may be present. It may or may not change the land capability class but it is always considered a factor to keep an area out of Class I.

Severe --- Soils of this class have been eroded to the extent that over 75 percent of the original surface layer is removed. The plow layer exhibits characteristics predominately of "B" horizon. Frequent crossable gullies, or occasional uncrossable gullies, or occasional wind blow-out area may be present.

Very severe --- Soils of this class have over 75 percent of surface soil removed with frequent uncrossable gullies and/or severe accumulations by wind. The plow layer exhibits characteristics similar to severely eroded soils. If wind is the main erosion force, blow-outs are numerous and deep. In either case, areas are unfit for crop production without extensive reclamation.

> The term "gullies" includes both crossable and uncrossable, unless otherwise specified. A crossable gully is one that can be crossed with normal, operating farm machinery. Frequent gullies are less than 100 feet apart. Occasional gullies are more than 100 feet apart.

Structure

Soil structure is not judged, however, it is very important because of its effect upon permeability. It also relates to how well crops can grow. It is necessary to know about this soil property. Structure means the shape and arrangement of soil particles into clusters or aggregates. Each aggregate has a particular shape or size and determines the type of soil structure. It is best to observe this property in the soil profile rather than in the sample box because of the disturbance. The various types are:

Single grained --- Each soil particle functions as an individual unit due to the lack of binding material. This structureless condition is usually found in coarse-textured soils.

Granular and/or subangular blocky --- Granular is sphere-like or rounded aggregate with no flat surfaces due to contact pressure from the faces of surrounding aggregates. Subangular blocky is block-like or tending toward six-faced aggregates having mixed, rounded and flat surfaces with many rounded vertices or corners.

Blocky --- Block-like or tending toward six-faced aggregates having flat surfaces with mostly sharp, angular vertices or edges that are mold casts formed by surrounding aggregates.

Prismatic --- Prism-like or vertically-oriented aggregates with the vertical axis much greater in length than the horizontal axis. Flat surfaces or faces are well defined.

Columnar --- Structure is a modified type of prismatic aggregate but with rounded surfaces. It usually suggests salty conditions.

Platy --- Plate-like or relatively thin horizontal plates or leaflets.

Massive --- Indistinct or no apparent aggregation. This type is characteristic of clayey, very slowly permeable soils Structure means the shape and arrangement of soil particles into clusters or aggregates. Each aggregate has a

particular shape or size and determines the type of soil structure.

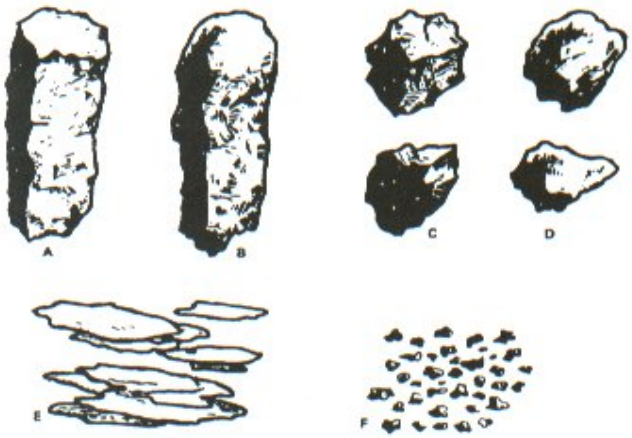


Figure 4. Drawings illustrate some of the types of soil structure: A—prismatic; B—columnar; C—angular blocky; D—subangular blocky; E—platy; and F—granular.

Interpretation of Soil Factors
Permeability
Permeability refers to the movement of air and water through the soil. Permeability is affected by many soil characteristics. It is extremely important because it affects the supply of air, moisture, and soil nutrients in the root zone available to the plant. A soil's permeability is determined by permanent characteristics such as texture, structure, and consistence. It may be increased or decreased and still remain within the range of each permeability rating.
Each soil layer has a permeability rating, but the soil's permeability is determined by the relative rate moisture and air move through the most restricting layer within the upper 40 inches of the effective root zone. For contests, the subsoil texture sample in the box will be used to determine the permeability. Subsoil texture and structure are of primary importance in determining permeability. Four levels of permeability are recognized in Oklahoma land judging.
Rapidly permeable --- Soils with coarse-textured subsoils that are granular or single-grained are rapidly permeable. Subsoils tend to be very friable or loose when moist, and exhibit little restriction of water or air.
Moderately permeable --- Moderately coarse- and medium-textured subsoils are moderately permeable regardless of structure. They are friable to very friable with large pores. Roots are abundant. A few soils with moderately fine texture and granular subsoils, are also moderately permeable.
Slowly permeable --- Soils that have moderately fine-textured subsoils with angular and subangular blocky structure are slowly permeable. The subsoils are firm when moist and hard when dry. Roots are common. Length differences of vertical and horizontal cracks are negligible. Soil peds often have thin, discontinuous, clay films on surfaces and tend to break more easily along the vertical axis than in the very slowly permeable soils. Soils frequently have thick surface and transitional horizons from the surface to the most clayey horizon in the profile.

Very slowly permeable --- Soils that have dense, fine-textured subsoils and claypan soils are very slowly permeable. Their structure is coarse, angular blocky or massive with very few visible pores. Roots are few and generally follow ped faces and cracks. These subsoils are very firm when moist and very hard when dry. Soil peds have thick, continuous, clay films on surfaces. Horizontal cracks are longer than vertical ones.

Surface Runoff

Surface runoff is the relative rate water is removed by flowing over the soil surface. This includes rainfall, as well as water from adjacent slopes. It is the combined effect of soil slope, position in the landscape, permeability, and infiltration rate on runoff. Four classes of runoff are recognized in Oklahoma land judging.

Rapid --- Water is removed from the surface at a rapid rate. A large amount of rainfall is lost and only a small portion moves into the soil increasing the erosion hazard. This is a result of compaction, clayey textures and/or slopes greater than 3% (except when the soils are rapidly permeable).

Moderate --- Water drains away readily but yet slow enough that a large amount of the water enters the soil. This condition causes little erosion hazard and is considered a normal amount of runoff. This condition occurs on slopes of 1% to 3% (except when the soils are rapidly permeable).

Slow --- Water flows away so slowly that free water covers the soil for moderate periods. This increases the moisture supply but may interfere with farming operation. This condition occurs on slopes of 0 to 1% and includes soils with moderate, slow, or very slowly permeable subsoils.

Very Slow --- Water is removed so slowly or stands so long that the soil remains wet for long periods. Most of the water either passes through the soil or evaporates. Generally this condition occurs on level to slightly concave slopes. However, deep sandy soils with rapidly permeable subsoils on slopes also have very slow runoff because the infiltration is so high that rainfall produces little or no runoff.

For contest, the subsoil texture sample in the box will be used to determine the permeability.

Major Factors That Affect Land Capability

These factors are conditions that keep land from being Class I. If only one factor keeps a site from being Class I, that factor determines land class. When two or more factors are involved, the situation may be more complex. The number to identify is not given and is the contestants decision. If other factors are listed on the site card, check the appropriate practice. Major factors include:

Surface Texture --- Surface soil texture is not a major factor except for sandy soils. Sandy soils can be no better than Class III because of erosion hazards of both wind and water that are very difficult to control.

Soil Depth --- Only shallow or very shallow soils will be major factors.

Slope --- Slope over 1% will be considered a major factor.

Erosion --- All conditions except none to slight will be considered a major factor.

Permeability --- Rapid or very slow permeability will be a major factor.

Surface Runoff --- Only very slow (rapidly permeable sandy soil excepted) and rapid runoff conditions will be considered as major factors.

General Guide for Selecting Land Capability Classes

Land Capability Classes

Land is classified by USDA on the basis of permanent limitations or hazards in its use from the standpoint of keeping the soil permanently productive. The soil features of a particular area are all considered when determining the land capability class. There are eight recognized classes of land. They are divided into cultivated and non-cultivated.

Cultivated

Class I --- Soils in Class I are suited for cultivation over a long period of time and have no limitations that restrict their use. They are deep, nearly level, well to moderately-well drained,

and subject to no more than slight erosion.
Class II --- Soils in Class II are suited for cultivation over a long period of time, but they have some hazards and limitations such as gentle slope, slight erosion, or moderate wetness that reduce the choice of plants or require moderate conservation practices that are easy to apply.
Class III --- Soils in Class III are good for cultivated crops, but have severe limitations that reduce the choice of plants and/or require special conservation practices that are more difficult to apply. Terracing and other water control measures will be needed.
Class IV --- Soils in Class IV can be cultivated, but they have very severe limitations that restrict the choice of plants, require very careful management, special conservation, or both. They are sloping, moderately eroded soils with poor characteristics. Cultivated areas should be strip tilled, terraced, and farmed on the contour. They are best suited for pasture and hay meadows.
Non-Cultivated
Class V --- Soils in Class V have little or no erosion hazards, but have other limitations that make them unsuitable for cultivation. Limitations are impractical and very expensive to remove and limits their use to pasture, range, woodland, or wildlife food and cover. Limitations include very poor surface and internal drainage or frequent flooding. (Frequent flooding will be shown with "other factors" when it occurs.)
Class VI --- Soils in Class VI have severe limitations such as steep slopes, severe erosion, shallowness, and rockiness that make them generally unsuited for cultivation and limits their use to pasture or range, woodland, or wildlife food and cover.
Class VII --- Soils in Class VII have many very severe limitations similar to Class VI that make them unsuited for cultivation and that restrict their use to grazing, woodland, or wildlife.
Class VIII --- Soils and land forms in Class VIII have limitations that preclude their use for crop, pasture, or timber production and restrict their use to wildlife, recreation, or aesthetics. This land has little or no economic value.

Soil Factor		Best Land Class
Texture (1):	Coarse textured Moderately coarse, medium Moderately line and fine	III I I
Depth (2):	Deep or moderately deep Shallow Very shallow	I III VII
Slope (3):	Nearly level (0 to 1%) Gently sloping (1% to 3%) Moderately sloping (3% to 5%) Strongly sloping (5% to 8%) Steep and very steep (8% to 15%+)	I II III IV VI
Erosion (4):	None to slight erosion Moderate Severe or very severe	I II VI
Permeability (5):	Rapid Moderate and slow Very slow	III I II
Runoff (6):	Rapid Moderate and slow Very slow	III I II

Interpretations of Land Treatments
Part 2 of Land Judging deals with vegetative and mechanical conservation practices used to

protect the soil and provide permanent protection. State and local conditions may require some modification of the following recommendations.

Vegetative

For cropland use on Class I through IV

1. Row crop with occasional close seeded soil-conserving crop -- applicable to Class I land.
2. Row crop with close seeded soil conserving crop every other year -- applicable to Class II land.
3. Row crops not more than 2 of 4 years -- applicable to Class III land.
4. Row crops not more than 1 of 4 years -- applicable to Class IV land.
5. Return crop residue to the soil.
6. Practice Conservation Tillage Ñ provides for a protective cover by leaving crop residue of any previous crop as a mulch on or mixed in the surface (first few inches) of the soil. At least 30% residue should remain on the soil surface after planting.

For Pasture, Range, Wildlife, or Commercial Woodland

7. Establish recommended grasses and legumes. This practice is used when permanent vegetation is needed. Because of differences in interpretation this practice will be used on all Class V, VI, and VII except where tree plantings are made.
8. Proper pasture or range management. The application of practices to keep plants actively growing; to encourage the growth of desirable grasses and legumes while crowding out weeds and brush, and minimize soil erosion.
9. Protect from burning.
10. Control grazing. Carry out a system of deferred or rotational grazing and proper stocking that will maintain or improve desirable vegetation on pasture or range. The practice should not be used where tree plantings are made.
11. Plant recommended trees for farmstead and field windbreaks, and commercial woodland plantings.
12. Harvest trees selectively. A system of cutting in which single trees, usually the largest, or small groups of such trees are removed and reproduction secured under the remaining stand.
13. Use only for wildlife or recreation area. This means protection or the development of areas that cannot be used for grazing, forestry, cultivation, or urban.

Mechanical

14. Control brush or trees. This may be accomplished by spraying with chemicals and/or use of machinery. The purpose is to improve the desirable vegetative cover by removing or killing undesirable brush and trees (Class I to VI). This practice should not be used when bushy plants and trees are less than two inches (2") in diameter at 5 feet above ground (Class I to IV). These can be controlled by normal farm plowing.
15. Terrace and farm on contour. Terrace is an embankment or ridge of earth constructed across the slope to control runoff and minimize erosion. Conduct farming operations on the contour or at right angles to slope direction. For contest purposes all cultivated soils with slopes over 1%, will be considered as needing terraces, except soils with coarse texture.
16. Maintain terraces. Practices that keep field terraces working effectively. Use only with practice 15.
17. Construct diversion terrace. A diversion terrace is a channel with a supporting ridge on the lower side. Usually it has greater horizontal and vertical spacing and is constructed to handle a larger flow of water than normal field terraces used when overhead water is a factor. This is always given information.
18. Install drainage system. The drainage system is used to remove excess surface or ground water from land by means of surface or subsurface drains. Used only when moderate wetness is given as a factor.
19. Control gullies. One or more conservation practices that will adequately control runoff and erosion. Used any time active gullies are within the field area. Gullies should be at least 6 inches deep and 12 inches wide. Irregularities, rills, and channels in a field that are grassed over with no signs of erosion are not considered as needing control, unless specifically given as a condition.
20. No mechanical treatment needed. Use when brush and trees, erosion, gullies, drainage, or

overhead water are not problems.

Fertilizer and Soil Amendments

Fertilizers and soil amendments are essential to the production of crops. No set of limits with regard to lime or fertilizer requirements will fit all areas of the country and all crops. The intent of this section is to familiarize contestants with soil fertility requirements and terminology and identify deficiencies from given soil test values.

pH

Soils with a pH of 5 or less are usually the soils requiring lime. However, lime is recommended on soils with a pH up to and including 6.3. Above this pH, no lime is recommended. Soils with a pH above 8.0 are alkaline and may indicate a salinity problem. The use of sulfur or similar amendment should be applied to reduce the pH to a more favorable level. Therefore, when any pH value given for a field is 6.3 or less or above 8.0, practice No. 21 is checked.

Phosphorus (P)

Low levels of phosphorus in Oklahoma soils are 25 lbs./acre or less. However, soils with phosphorus levels up to 60 lbs./acre do require the addition of phosphorus for maximum production. When any value is given less than 60 lbs./acre, check No. 22 on the scorecard.

Potassium (K)

Soils with potassium levels of 125 lbs./acre or less are considered deficient and require the addition of potassium. Potassium is recommended to some extent on soils with as much as 300 lbs./acre for certain crops, but above that level no potassium is added. When any value is given that is less than 300 lbs./acre, check No. 23 potassium on the scorecard.

Nitrogen (N) No established level of nitrogen in the soil adequately indicates sufficiency or deficiency for all crops. Any value that would be deficient for corn, cotton, or small grains may be adequate for clovers or alfalfa. On the other hand, an adequate level of nitrogen for small grains or corn may be a deficient amount for maximum production of Bermuda grass. The adequate level of nitrogen in the soil is dependent on the yield goals.

For contest purposes, nitrogen will be given as adequate or deficient without a numerical value. Check nitrogen, No. 24 on the scorecard, when the deficiency is indicated.

Example: Soil test information shows:

pH --- 5.5
Phosphorus --- 30 lbs./acre
Potassium --- 325 lbs./acre
Nitrogen --- Deficient
On the scorecard Nos. 21, 22, and 24 will be checked.

General Instructions and Interpretations

Contestants from distant areas will tend to interpret what they see in light of their own conditions. For this reason it is necessary to explain in detail those items that may have local variations.

Present Practices or Cover on the Land

Disregard practices and/or cover on the land at the time of the contest, except for brush and trees that might occur on Class I and VI. Should this condition occur, it would be necessary to remove brush, trees, and timber to reach the most intensive use. In other words, use practice 14. If terraces are needed and terraces are already on the area use practice 15, terrace and farm on the contour. Should a cover of grass be on an area of Class V, VI, or VII land, use practice 7, establish recommended grasses or legumes.

Other Factors

When factors exist that are not observable by the contestant from a single observation, but affect the treatment and land capability, they will be given for each field under "other factors." Contestants will then prescribe the correct treatment based on these factors. Factors that will be given that influence treatment are:

Wetness --- Wetness would be a factor to keep land out of Class I. Only moderately-wet land can effectively benefit from installation of a drainage system. Use practice 18 under treatments.

Installing drainage system on wet, Class V soil is not recommended.
Flooding --- Flooding is not considered on slopes over 3 percent. Flooding would place an area in Class V. Practices 14 and 20 would be possible treatments.
Overhead Water --- This condition does not change the land class out of Class I, but would require a diversion terrace (practice 17). Practice 16 is not checked when using diversion terraces. They are constructed much larger than conventional terraces and are usually not farmed. These could be constructed on adjoining property where maintenance was not possible.
Needs Wind Break --- Where this is indicated, practices 9 and 11 would be needed.
Desires Post or Wood Lot --- This factor shown would call for practices 9, 11, and 12.
Timber production --- Operator desires to go into timber production in adapted areas. Would also require practices 9, 11, and 12.

Guide to Capabilities and Treatment Practices

In order to insure uniformity in teaching, Tables 1 to 5 have been specially prepared. These tables are designed to show various combinations of soil, texture, permeability, depth, slope, erosion, runoff, wetness, and flooding that could occur, and the resulting capability class. Applicable treatments are also shown. Please study the special notes at the beginning and end of each table.

The following abbreviations are used in Tables 1 to 4.

V.S. = very slowly permeable or very slow surface runoff
S. = slow permeability or slow surface runoff
M. = moderately permeable, moderate erosion, or moderate surface runoff
R. = rapid permeability or rapid runoff
N. = none to slight erosion
Sev. = severe erosion
V.Sev. = very severe erosion
N.L. = nearly level
G.S. = gently sloping
M.S. = moderately sloping
Str. = strongly sloping
Steep = steep slopes
V.Steep = very steep slopes

General Notes

Coarse Textured Soils -- Deep and Moderately Deep

1. Coarse surface soil texture is a major factor that keeps a soil out of Class I.
2. The best land capability class for coarse textured soils is Class III.
3. Slopes from 1 to 3 percent are considered a major factor, but will not lower the land capability class.
4. Moderate erosion will be checked as a major factor, but will not lower the land capability class.
5. Either very slow or rapid surface runoff will be checked as a major factor, except where the soil is rapidly permeable, but these factors will not lower the land capability class.
6. Rapid permeability will be checked as a major factor, but it will not lower the land capability class.
7. In combination with texture, slopes over 3 percent and severe or very severe erosion are major factors that lower the land capability class from III or IV to VI.
8. The best land capability class for coarse textured soils on slopes of less than 3 percent with severe or very severe erosion is Class VI.
9. The best land capability class for coarse textured soils on moderately sloping or strongly sloping soils is Class IV.
10. The best land capability class for coarse textured soils on moderately sloping or strongly sloping soils with severe or very severe erosion is Class VI.
11. The best land capability class for coarse textured soils on steep or very steep slopes is Class VI.
12. Shallow or very shallow, coarse textured soils will not be used in contests.

Table I. Coarse Textured Soils - Deep and Moderately Deep

Slope	Erosion	Permeability	Surface Runoff	Capability Class	Factors that keep land out of Class I	Vegetative Treatment	Possible Mechanical Treatment* use one or more
N.L.	N	S	S	III	1	3,5,6	14,20
N.L.	M	S	S	III	1,4	3,5,6	14,20
N.L.	Sev. &V. Sev.	S	S	VI	1,4	7,8,9,10	14,19,20
G.S.	N	S	M	III	1,3	3,5,6	14,20
G.S.	M	S	M	III	1,3,4	3,5,6	14,20
G.S.	Sev. &V. Sev.	S	M	VI	1,3,4	7,8,9,10	14,19,20
N.L.	N	M	V.S.	III	1,6	3,5,6	14,20
N.L.	M	M	V.S.	III	1,4,6	3,5,6	14,20
N.L.	Sev. &V. Sev.	M	V.S.	VI	1,4,6	7,8,9,10	14,19,20
G.S.	N	M	M	III	1,3	3,5,6	14,20
G.S.	M	M	M	III	1,3,4	3,5,6	14,20
G.S.	Sev. &V. Sev.	M	M	VI	1,3,4	7,8,9,10	14,19,20
M.S.	N	M	R	IV	1,3,6	4,5,6	14,20
M.S.	M	M	R	IV	1,3,4,6	4,5,6	14,20
M.S.	Sev. &V. Sev.	M	R	VI	1,3,4,6	7,8,9,10	14,19,20
Str.	N	M	R	IV	1,3,6	4,5,6	14,20
Str.	M	M	R	IV	1,3,4,6	4,5,6	14,19,20
Str.	Sev. &V. Sev.	M	R	VI	1,3,4,6	7,8,9,10	14,19,20
Steep	All	M	R	VI	1,3,6 also 4	7,8,9,10	14,19,20
V.Steep					If eroded		
N.L.	N	R	V.S.	III	1,5	3,5,6	14,20
N.L.	M	R	V.S.	III	1,4,5	3,5,6	14,20
N.L.	Sev. &V. Sev.	R	V.S.	VI	1,4,5	7,8,9,10	14,19,20
G.S.	N	R	M	III	1,3,5	3,5,6	14,20
G.S.	M	R	V.S.	III	1,3,4,5	3,5,6	14,20
G.S.	Sev. &V. Sev.	R	V.S.	VI	1,3,4,5	7,8,9,10	14,19,20
M.S.	N	R	V.S.	IV	1,3,5	4,5,6	14,20
M.S.	M	R	V.S.	IV	1,3,4,5	4,5,6	14,20
M.S.	Sev. &V. Sev.	R	V.S.	VI	1,3,4,5	7,8,9,10	14,19,20
Str.	N	R	V.S.	IV	1,3,5	4,5,6	14,20
Str.	M	R	V.S.	IV	1,3,4,5	4,5,6	14,20
Str.	Sev. &V. Sev.	R	V.S.	VI	1,3,4,5	7,8,9,10	14,19,20

Steep	All	R	All	VI	1,3,5, also 4	7,8,9,10	14,19,20
V. Steep					If eroded		

Moderately Coarse, Medium, Moderately Fine, and Fine Textured Soils --- Deep and Moderately Deep

1. Surface soil texture is not a major factor that keeps a soil out of Class I.
2. The best land capability class for moderately coarse, medium, moderately fine, and fine soils is Class I.
3. Slope of less than 1 percent is not a major factor.
4. Slope over 1 percent is a major factor and will lower the land capability class.
5. Very slow permeability is a major factor and will further lower the land capability class by one unit on land Classes I through IV.
6. Very slow surface runoff is a major factor and it will lower the land capability by one unit.
7. Rapid surface runoff is a major factor, but it will not lower the land capability class.
8. Moderate erosion is a major factor that will lower the land capability class on slopes less than 3 percent. Moderate erosion is a major factor, but it will not lower the land capability class on slopes over 3 percent.
9. The best land capability class for severe and very severely eroded soils is Class VI.
10. The best land capability class for moderately coarse, medium, moderately fine and fine soils on 0 to 1 percent slopes that is moderately wet is Class II. Wet soils can be no better than Class V. The degrees of wetness will be given. Wetness will be checked as a major factor and will lower the land capability class.
11. On nearly level slopes, moderate erosion can occur. However, such a condition will not be used in land judging contests.

Table II. Moderately Coarse, Medium, Moderately Fine and Fine Textured Soils - Deep and Moderately Deep

Slope	Erosion	Permeability	Surface Runoff	Capability Class	Factors that keep land out of Class I	Vegetative Treatment	Possible Mechanical Treatment* use one or more
N.L.	N	V.S.	S	II	5	2,5,6	14,20
N.L.	N	V.S.	V.S.	III	5,6	3,5,6	14,18,20
G.S.	N	V.S.	M	III	3,5	3,5,6	14,15,16
G.S.	M	V.S.	M	IV	3,4,5	4,5,6	14,15,16
G.S.	Sev. & V. Sev.	V.S.	M	VI	3,4,6	7,8,9,10	14,19,20
M.S.	N	V.S.	R	IV	3,5,6	4,5,6	14,15,16
M.S.	M	V.S.	R	IV	3,4,5,6	4,5,6	14,15,16
M.S.	Sev. & V. Sev.	V.S.	R	VI	3,4,5,6	7,8,9,10	14,19,20
Str.	N	V.S.	R	VI	3,5,6	7,8,9,10	14,20
Str.	M, Sev. & V. Sev.	V.S.	R	VI	3,4,5,6	7,8,9,10	14,19,20
Steep V. Steep	Very Sev. & V. Sev.	V.S.	R	VII	3,4,5,6	7,8,9,10	14,19,20
N.L.	N	S&M	S	I	9	1,5,6	14,20

N.L.	N	S&M	V.S.	II	6	2,5,6	14,20
N.L.	M	S&M	S	II	4	2,5,6	14,20
G.S.	N	S&M	M	II	3	2,5,6	14,15,16
G.S.	M	S&M	M	III	3,4	3,5,6	14,15,16
G.S.	Sev. & V. Sev.	S&M	M	VI	3,4	7,8,9,10	14,19,20
M.S.	N	S&M	R	III	3,6	3,5,6	14,15,16
M.S.	M	S&M	R	III	3,4,6	3,5,6	14,15,16
M.S.	Sev. & V. Sev.	S&M	R	VI	3,4,6	7,8,9,10	14,19,20
Str.	N	S&M	R	IV	3,6	4,5,6	14,15,16
Str.	M	S&M	R	IV	4,5,6	4,5,6	14,15,16
Str.	Sev. & V. Sev.	S&M	R	VI	3,4,6	7,8,9,10	14,19,20
Steep V. Steep	N	S&M	R	VI	3,6	7,8,9,10	14,20
Steep V. Steep	M	S&M	R	VI	3,4,6	7,8,9,10	14,19,20
Steep V. Steep	Sev. & V. Sev.	S&M	R	VI	3,4,6	7,8,9,10	14,19,20

Moderately Coarse, Medium, Moderately Fine, and Fine Textured Soils -- Shallow

1. Surface soil texture is not a major factor keeping the soil out of Class I.
2. The best land capability class for shallow soils is Class III.
3. Depth is a major factor and the best land class is Class III.
4. Slope of less than 1 percent is not a major factor.
5. Slope of 1 to 3 percent is a major factor, but will not lower the land capability class.
6. Slope over 3 percent is a major factor and will lower the land capability one unit.
7. Moderate erosion is a major factor that will lower the land capability class on 0 to 1 and 1 to 3 percent slope.
8. Moderate and severe erosion will be checked as a major factor on 3 to 5 percent slope, but it will not lower the land capability class.
9. Very severe erosion is a major factor that will lower the capability class by one unit.
10. Very slow permeability is a major factor but it will not lower the land capability class.
11. Very slow or rapid runoff will be checked as major factors, but they will not lower the land capability class.
12. Mechanical practices 15 (terrace) and 16 (terrace maintenance) are not used on slopes of less than 1 percent, even though the land capability class is Class III.

Table III. Moderately Coarse, Medium, Fine and Fine Soils - Shallow

Slope	Erosion	Permeability	Surface Runoff	Capability Class	Factors that keep land out of Class I	Vegetative Treatment	Possible Mechanical Treatment* use one or more

N.L.	N	All Conditions	S	III	2	3,5,6	14,20
N.L.	M		S	IV	2,4	4,5,6	14,20
G.S.	N		M	III	2,3	3,5,6	14,15,16
G.S.	M		M	IV	2,3,4	4,5,6	14,15,16
M.S.	N		R	IV	2,3,6	4,5,6	14,15,16
M.S.	M		R	IV	2,3,4,6	4,5,6	14,15,16
Str. Steep & V. Steep	N.M. & Sev.		R	VI	2,3,6 also 4 if eroded	7,8,9,10	14,19,20
Str. Steep V. Steep	V. Sev		R	VII	2,3,4,6	7,8,9,10	14,19

Table IV. Moderately Coarse, Medium, Fine and Fine Soils - Very Shallow

Slope	Erosion	Permeability	Surface Runoff	Capability Class	Factors that keep land out of Class I	Vegetative Treatment	Possible Mechanical Treatment* use one or more
All	All	All Conditions	All	VII	5 if V.S. 2 in all cases 3 if sloping 4 if eroded 6 if rapid runoff	7,8,9,10	14,19,20

Table V. Special Factors (conditions) Deep Soils

Slope	Erosion	Permeability	Other Factors	Capability Class	Factors that keep land out of Class I	Vegetative Treatment	Possible Mechanical Treatment* use one or more
All	All	All	Mod. Wet	II	7	2,5,6	14,18
All	All	All	Wet	V	7	7,8,9,10	14,20
All	All		Flooding	V	8	7,8,9,10	14.20

Special Notes

Possible Mechanical Treatments

This column cannot be specific in all cases. It is the job of the contestants to pick out the treatments that apply. For example, a field can be found that would need no mechanical treatment for the most intensive use. Therefore, practice 20 would be shown. A similar field in soil, slope, and erosion could be covered with undesirable brush and trees and would need practice 14. Should a field also be gullied, practices 14 and 19 would be used. Depending on soil, slope, cover, erosion, and most intensive use, practices 14, 15, 16, or 15 and 16 could be the correct answer.

Class I land in grass or cultivation would require practice 20. The same class of land covered by brush and trees would require practice 14. In other words, any field will need to have one or more of the possible mechanical practices checked that are shown under the heading "Mechanical" on the scorecard.

Other Factors

"Other factors" shown on the condition sheet will be a key to treatment needs. These treatments are not shown under mechanical treatments, but have been discussed elsewhere in this booklet. When conditions warrant, these will be noted on the condition sheet along with other given information. The contestant will need to check the appropriate condition on the scorecard.

All explanations given in this booklet are for teaching and understanding.Because of the possibility of overlooking a difference between the narratives and the tables, the tables will be the final word in contest situations.

Setting Up and Holding a Land Judging Contest

Plan

The coordinator or chairman needs to set up a meeting of interested leaders and agencies. Determine who can help and make assignments. As soon as the contest date is set, leaders should select judges, helpers, and graders. In planning, consider the number of teams, divisions, and number of individuals that will participate. A team consists of three or four contestants, with the three high scores tabulated as the official team score.

Site Selection

Locate a farm where different conditions can be found to judge. Secure permission from the owner to use the area. Select four sites, dig pits, and prepare an official scoring key for each site, before the contest. This will insure that graders can score the contest in the shortest possible time.

Preparing Field Sites

Each site should have colored flags to indicate field boundaries of the area to be judged. The fields should be a minimum of 100 feet x 100 feet in size, but it does not necessarily have to be square. Two well-marked stakes should be placed 100 feet apart for contestants to use to determine slope. These should be the same distance above the ground and as much as possible with the normal slope of the land. A hole or trench must be dug to expose the depth of the soil profile. It is best to use string to mark off an area in the trench as an "off limits area" that contestants use only to determine topsoil thickness and soil depth. Representative topsoil and subsoil samples should be available in boxes and appropriately marked. If the soil is very dry, a water bottle should be available to moisten soil samples.

Site Card

This card provides the contestant with all necessary information to judge the site. It should be prepared in advance and placed at the site before the contest. Include the field number, thickness of original topsoil, soil test data, and any other factors on the card.

Conducting the Contest

Register teams by using consecutive numbers, and team members by using 1,2,3,4. Have sets of land judging cards prepared ahead of time if a large number of contestants are expected. When the contest begins, #1 contestant will go to site 1, #2 to site 2, #3 to site 3, and #4 to site 4. Allow 15 to 20 minutes to judge each site. Additional time will be required if homesite evaluation is also being judged. Use a signal to start and stop the judging at each site. Each group then moves to the next site. Group 1 goes to site 2, Group 2 to site 3, Group 3 to site 4, and Group 4 to site 1. Sites do not always have to be arranged to fit this sequence. When using the computerized card, collecting of card is done when the contestant completes the last site. Have someone designated to pick up the cards and take them to the graders. This procedure allows groups of 20 to 40 people to move without confusion.

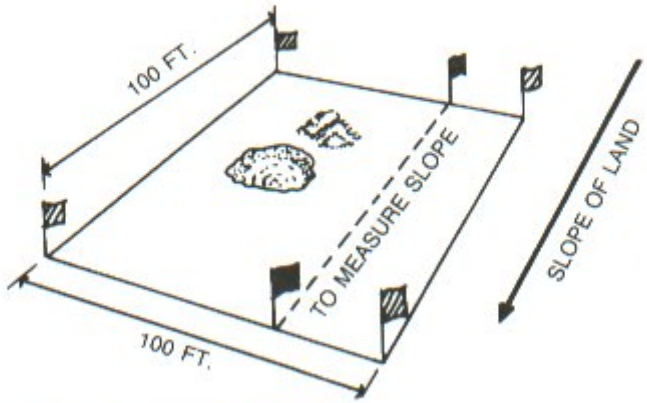


Figure 5. Preparing a Field Site.

General Contest Rules

1. No talking, comparing, or copying of cards.
2. Clear plastic clipboards are allowed.
3. No water bottles. Water to moisten soil will be provided as needed.
4. No bubble vile, tape measure, or other measuring devices are allowed.
5. Contestants can have the following pieces of equipment:
   a. soft lead writing pencil with a good eraser.
   b. knife or nail.
   c. towel or rag.
   d. contest cards.
6. The land judging handbook shall be used to resolve contest differences and should be used in setting up and conducting all contests.
7. Decisions of the judges will be FINAL!

Scoring and Grading

Categories on the scorecard carry varying values depending on the judges evaluation of its relative importance. The total points possible on each site are 75 with 45 points from Part I and 30 points from Part II. See the following example. In Part I, items have only one correct answer, except "Major Factors" must have all appropriate blocks checked to get credit for the answer. In Part II, the applicable vegetative, mechanical, and fertilizer practices are checked according to the judgment of the contestant and other given factors. No partial credit is awarded.

Use a master sheet to simplify the entry of individual scores by listing team members vertically and sites horizontally on the sheet. Circle the low total score for elimination. Team scores can then be added up quickly.

In the case of a tie in the team score, first use the score of the 4th individual. If one team has only three members, the team with the 4th member is the winner. If a tie still exists, use the scores from Site 1, then use Site 2, Site 3, and Site 4 and the team with the first largest score can be declared the winner. If this does not break the tie, the score from Part I, then Part II of Site 1, Site 2, Site 3, and Site 4 can be used. If this procedure fails, all team names with tied scores can be placed in a hat and drawn for placings. This same procedure can be used to break individual tied scores.

Example of Scoring for Land Judging.

Part I of Land Judging Scorecard			*Part II of Land Judging Scorecard*	
Items	*Points*		*Possible Practices*	*Points*
A. Texture			No. 3	6
Surface	4			
Subsoil	4		No. 5	4
B. Depth of Soil	5		No. 6	5
C. Slope	4		No. 16	6
D. Erosion	4		No. 16	4
E. Permeability	5		No. 25	5
F. Surface Runoff	3			
G. Major Factors	8			
H. Land Capability				
Class	8			
	Points	45	Points	30
	Total		Points 75	

Judging Land for Homesites

there is a flood hazard. Avoid homes in a flood plain unless there is adequate flood protection.
drainage is a problem.
the soils have high shrink-swell properties.
slope and unstable soil make erosion and soil movement a major problem.
soil conditions exist that corrode pipes easily and require frequent replacement.
grading and soil removal was extensive. Was the surface soil replaced?
the soil properties are favorable for lawn, shrubs, trees, flowers, and vegetables without extensive soil modification.

This contest is designed to emphasize the importance of soils and their limitations for homesites. The importance of a soil's suitability for parks, playgrounds, roads, streets, and other uses can also be considered. Many of the properties important for agricultural uses are also important for urban uses. While the properties are the same, a different set of criteria is used to evaluate urban uses.

Defining Limitations

Soils have limitations in use depending on their inherent properties. In homesite evaluations, the soils are rated as having slight, moderate, severe, or very severe limitations as follows:

Slight limitations -- Soils or sites have properties favorable for the planned use and present few or no problems. Low maintenance can be expected.

Moderate limitations -- Soils or sites have one or more properties considered somewhat restrictive for the planned use. Limitations may be overcome or modified with special planning, design, treatment, or maintenance.

Severe limitations -- Soils or sites have one or more properties unfavorable for the planned use. Limitations are very difficult and expensive to modify or overcome for the desired use. A severe rating means that extensive, costly work needs to be done to overcome the soil limitations for the use desired.

Very severe limitations -- Soils or sites have features so unfavorable for a particular use that overcoming the limitations is very difficult and extremely expensive and generally should not be used for the purpose being rated.

Defining Land Uses

Limitation ratings will be made for four homesite uses: (1) foundations for buildings, (2) lawns and landscaping, (3) septic system absorption field, and (4) sewage lagoon. Ratings for other uses can be made but are not included in this contest.

Foundations for buildings -- This determination reflects the suitability of the soil to support buildings. Some important soil properties that affect building foundations are soil depth, slope, shrink-swell potential, water table, and flooding.

Lawns and landscape plantings -- This rating reflects the use of the soil for growing lawns, shrubs, trees, and vegetable gardens. The important soil properties are those that affect establishment and maintenance of planting. They include texture, permeability, soil depth, runoff, water table, plant response when fertilizer is applied, and absence of toxic materials such as salts.

Septic tank absorption field -- Subsurface systems of tile or perforated pipe that distribute waste water (effluent) from a septic tank into the soil for purfication. Properties and features that affect the absorption of the effluent are permeability, water table, soil depth, and flooding. Stones and shallow depth may interfere with installation and excessive slope can affect the operation of the system.

Sewage lagoon -- A dug pond used to hold sewage solids for bacterial decomposition and effluent evaporation is a sewage lagoon. Consideration of the soils ability to impound water and for use as embankment material must be made. Soil properties affecting sewage lagoons are soil texture, permeability, soil depth, water table, slope, and flooding.

Factors Affecting Suitability

Texture

This refers to the texture of the surface soil. Surface texture is not a factor for septic systems and sewage lagoons because lagoons and lateral lines are dug below the surface.

Coarse: Moderate limitations for all uses -- May require stabilization with organic material and/or loamy topsoil to improve moisture and nutrient holding and supplying capacity for desired plant growth. Water and wind erosion may be a problem during construction.

Moderately Coarse, Medium, Moderately Fine: None to slight limitations for all uses -- Care should be exercised during construction to be sure the surface soil is not covered by less desirable material.

Fine: Severe limitations for all uses, except none to slight limitations -- For sewage lagoons. Soil is sticky when wet, hard when dry, and difficult to work with in flower beds and gardens. The soils crack when dry, swell when wet, requiring frequent and low rate of watering for plant growth.

Permeability

This refers to the rate water or air moves through the most restricted layer in the soil. This may be considered as internal drainage. Laterals for septic systems may be located below such layers in some soils. Final design should be based on detailed study of permeability, seasonally high water tables, and a standard percolation test to determine infiltration rates where soils are slow or very slowly permeable. These investigations are important factors in deciding between septic tank absorption fields, sewage lagoons, or a community sewage system. Generally, soils unsuited for septic systems are much better suited for lagoons. For septic systems, evaluate the permeability of soil layers below 30 inches and for sewage lagoons evaluate the layers between 12 to 60 inches.

Special note: For contest purposes, permeability will be determined from the subsoil texture box.

Rapid: *Slight limitations* for septic system absorption field. *Moderate limitations* for lawns and landscape planting. *Severe limitations* for sewage lagoons. The soils are coarse textured. Permeability is more than 2 inches per hour. If the permeability is greater than 6 inches per hour, seepage from lagoons will occur and make it difficult to maintain adequate water depth and could contribute to ground water pollution. Septic systems may not adequately filter waste water. When the permeability is greater than 6 inches per hour, it is considered a very severe limitation for both septic systems and lagoons.

Moderate: *Moderate limitations* for septic system absorption field and sewage lagoons. The soils are moderately coarse and medium textured with weak prismatic to blocky and strong granular structure. Permeability ranges from 0.6 to 2 inches per hour. *None to slight limitations* for lawns and landscape plantings.

Slow: *Severe limitations* for septic system absorption field. Soils are generally moderately fine textured with a subangular blocky structure. Problems are generally similar to the very slowly permeable soils but the modifications required for use are less intense. Permeability ranges from 0.06 to 0.6 inches per hour. Percolation tests should be run to design a suitable septic tank disposal field. At the .06 inch per hour rate (1 1/2 inches per day), the cost of modifications and size of filter field would be prohibitive. Limitations would be none to slight for sewage lagoons and moderate for lawns and landscape plantings.

Very Slow: *Very severe limitations* for septic system absorption field. Permeability is less than 0.06 inches per hour. This would require a prohibitively large field of laterals or costly modifications would be necessary to effectively dispose of the effluent. Septic systems are generally not recommended. *None to slight limitations* for sewage lagoons. Subsoils are fine textured and break into sharp angular blocks or clods that are plastic and sticky when wet and very hard when dry. The clods are usually coated with clay which restricts water movement. Severe limitations for lawns and landscape plantings.

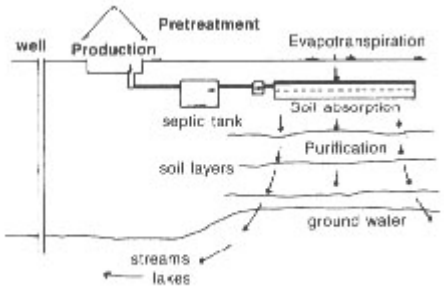


Figure 6. Soil Disposal of Septic Tank Effluent.

Soil Depth

This refers to the vertical depth of a soil to bedrock such as sandstone, limestone, or consolidated clays that restrict roots and excavations. Severity of limitations because of depth vary greatly for different uses. Table 6 is a guide for evaluation of soil depth for homesite uses.

Slopes

This refers to the steepness of the surface or the vertical rise or fall over 100 feet of distance, expressed in percent. Broader and different slope ranges apply to homesite use considerations than normally apply to considerations for agricultural uses. Table 7 will aid in interpretation of the slope condition for homesite evaluation.

Table 6. Effect of Soil Depth on Land Use Adaptation.

	Depth in Inches	*Foundations for Buildings*	*Lawns and Landscaping*	*Septic System Absorption Field*	*Sewage Lagoon*
V. Shallow	<10"	V. Severe	V. Severe	V. Severe	V. Severe
Shallow	10-20"	Severe	Severe	V. Severe	V. Severe
Mod. Deep	20-40"	Moderate	Moderate	Severe	Severe
Deep	40-72"	None to Slight	None to Slight	Moderate	Moderate
V. Deep	72"	None to Slight	None to Slight	None to Slight	None to Slight

Table 7. Effect of Slope on Land Use Adaptation.

	Slope in Percent	Foundations for Buildings	Lawns and Landscaping	Septic System Absorption Field	Sewage Lagoon
Nearly Level to Gentle Sloping	0-3	None to Slight	None to Slight	None to Slight	None to Slight
Mod. Sloping	3-5	None to Slight	None to Slight	None to Slight	Moderate
Strongly Sloping	5-8	None to Slight	None to Slight	None to Slight	Moderate
Steep	8-15	Moderate	Moderate	Moderate	Severe
V. Steep	15+	Severe	Severe	Severe	Severe

Erosion

Erosion of the soil can increase the expense of landscaping and require additional topsoil to be brought onto the site. Severe gullies will impose additional limitations on septic system absorption fields.

None to Slight and Moderate: None to slight limitations for any use.

Severe: Moderate limitations for any use.

Very Severe: Severe limitations for any use. Usually severely gullied areas require much filling and leveling, extra expense on septic system absorption field, and extensive modification for flower beds, lawns, etc.

Surface Runoff

This is generally a factor of importance in connection with drainage, permeability, and erosion. Special attention needs to be given to surrounding areas. Runoff from adjacent areas onto building sites and the possibility of ponding water around the building foundation need consideration. Surface runoff is not a factor for sewage lagoons because they will be protected from outside water.

Rapid: Occurs on slopes above 5% except on deep sands where runoff would be slow. Severe limitations requiring care to maintain and to prevent erosion on lawns and gardens. None to slight limitations for foundation for buildings and septic systems absorption field.

Moderate: None to slight limitations for foundations and septic systems. Moderate limitations for lawns and landscape plantings. Occurs on slopes of 3% to 5%.

Slow: Occurs on nearly level to very gently sloping areas (0 to 3%) and deep sands. Moderate limitations may require modification for building foundations and special design of septic system absorption field. On deep sands, slow runoff would not present any limitations. None to slight limitations for other uses.

Shrink-Swell

This factor is implied in the permeability, texture, and mineralogy of a soil. Because it is important in foundation design, it should have special consideration. The most clayey layer in the profile is generally considered in shrink-swell limitations. Shrink-swell is not generally a factor for lawns and landscape plantings.

Low: Coarse and moderately coarse textured soils have none to slight limitations for all uses.

Moderate: Medium and moderately fine textured soils have moderate limitations for all uses, except none to slight for sewage lagoons.

High: Fine textured soils have severe limitations for all uses, except none to slight for sewage lagoons.

Water Table

The internal wetness of an area is influenced by most of the factors previously discussed. Generally, internal

drainage is a reflection of permeability. However, the presence and depth to a water table is more a reflection of climate, season, and landscape position. It must be evaluated on the basis of depth to the seasonal high level and the permanency of the water table. This requires study during different times of the year and under differing climatic conditions.

Table 8. Depth to Water Table (inches).

Degree of Limitation	Foundations for Buildings	Lawns and Landscaping	Septic System Absorption Field	Sewage Lagoon
Slight	More than 30	More than 24	More than 72	More than 60
Moderate	18-30	12-24	48-72	40-60
Severe	Less than 18	Less than 12	Less than 48	Less than 40

For contest purposes, water table depth will be given information. A water table is:
deep if it is greater than 72 inches.
moderately deep if it is between 40 to 72 inches.
shallow if it is less than 40 inches.

Flooding

The occurrence of floods is a factor frequently overlooked in planning the use and management of land. Flooding may not occur on an area for many years, then a serious flood can occur. Urban development on the watershed of a small stream can increase runoff up to 75%, thus greatly increasing the flood hazards. Soils may give an indication of flooding, but records must be studied to determine the true condition. Position in the landscape and proximity to nearby streams are good indicators of frequency of flooding. In contests this is normally given information.

None: *None to slight* limitations for all uses.

Occasional: Flooding less frequent than one year in two. Severe limitations for foundations for buildings. Moderate limitations for septic system absorption field. None to slight limitations for sewage lagoon and lawns and landscaping.

Frequent: Flooding more frequent than one year in two. Severe limitations for all uses.

Conducting Homesite Evaluation

Homesite evaluation contests are conducted in the same manner as land judging. Additional items must be added to the given information site card. The contestant should be given 15 minutes to fill out a scorecard. If both land and homesite evaluation are judged simultaneously, a combined time of 20 to 25 minutes is ample.

To avoid having the contest become too long and the grading burdensome by adding homesite evaluation, several alternatives are possible.

1. Use three land and two homesites for judging.
2. Use four land sites and use the same sites but evaluate only for one or two uses for each site.
3. Others.

The only concern is to make sure that there are enough interpretative uses required to test the contestants skill in homesite evaluation.

***Use the attached soils related web links to research additional information related to the 2004 Canon Envirothon Soils/LandUse Key Points! Contact USDA for latest Farm**

Bill Conservation Program Info!

Soil is an important and dynamic resource

http://soils.usda.gov/sqi/soil_quality/what_is/sqiinfo.html
http://soils.usda.gov/education/facts/
http://soils.usda.gov/sqi/sitemap.html
http://hintze-online.com/sos/soils-online.html
http://www.swcs.org/t_resources.htm
http://www.agsites.net/links/soilresource.html
http://www.swcs.org/f_orglinks_links.htm
http://www.cyber-sierra.com/area9/p-soils.html
http://attra.ncat.org/
http://www.des.ucdavis.edu/iad217/soilsites.html
http://www.jsasd.k12.pa.us/mhopple/nature/soils.htm
http://www.agronomy.lsu.edu/LACSE/lacse.htm
http://www.slider.com/Science/Agriculture/Soils__4.html

Features of a Soil Profile

http://www.uwsp.edu/geo/faculty/ritter/geog101/modules/soils/soil_development_profiles.html
http://ltpwww.gsfc.nasa.gov/globe/soilgall/images/images.htm
http://soils.usda.gov/education/resources/k_12/lessons/profile/

Soil Properties and Formation Factors

http://www.uwsp.edu/geo/faculty/ritter/geog101/modules/soils/soil_development_soil_properties.html
http://www3.uakron.edu/geography/lrb/soilsf97/lectures/soilprop1/
http://www3.uakron.edu/geography/lrb/soilsf97/lectures/properties2/
http://pas.byu.edu/biol150/pres/soil1/

Soil Parent Materials

http://www.uwsp.edu/geo/faculty/ritter/geog101/modules/soils/soil__development_soil_forming_factors.html
http://www.cst.cmich.edu/users/Franc1M/esc334/lectures/origin.htm
http://www.cst.cmich.edu/users/Franc1M/esc334/lectures/origin.htm
http://interactive.usask.ca/ski/agriculture/soils/soilform/soilform_fact.html
http://www.nal.usda.gov/ttic/tektran/data/000011/11/0000111155.html

Soil Characteristics

http://iaswww.com/ODP/Science/Agriculture/Soils
http://ltpwww.gsfc.nasa.gov/globe/links/charac.htm
http://www.renewedearth.com/learn/soil.htm
http://web.ukonline.co.uk/fred.moor/soil/formed/f0108.htm

Soil Properties and Limitations

http://ianrpubs.unl.edu/soil/g831.htm
http://mather.ar.utexas.edu/AV/CRP369K/Lectures/Soils.pdf
http://soils.usda.gov/technical/fieldbook/

Relationship of Plant Nutrients and Soil Material
Characteristics of Wetland (hydric) Soils

http://www.pwrc.nbs.gov/fieldin.htm
http://academic.emporia.edu/aberjame/wetland/soils/soils2.htm
http://www.michigan.gov/deq/1%2C1607%2C7-135-3313_3687-10408--%2C00.html

Soil Drainage Classes and Defining Wetlands

http://www.deq.state.mi.us/documents/deq-water-wetlands-idmanualchap1.pdf
http://www.deq.state.mi.us/documents/deq-water-wetlands-idmanualchap2.pdf
http://www.deq.state.mi.us/documents/deq-water-wetlands-idmanualchap3.pdf
http://www.deq.state.mi.us/documents/deq-water-wetlands-idmanualchap4.pdf
http://www.deq.state.mi.us/documents/deq-water-wetlands-idmanualchap5.pdf
http://www.deq.state.mi.us/documents/deq-water-wetlands-idmanualchap6.pdf

Soil Water Movement, Storage, and Uptake by Plants

http://edis.ifas.ufl.edu/TOPIC_Soil_Water_Relationships
http://pas.byu.edu/AgHrt100/soilwate.htm
http://interactive.usask.ca/ski/agriculture/soils/soilphys/soilphys_wat.html
http://agrifor.ac.uk/browse/cabi/detail/38750e18f41d143efc78c100e90e97c2.html
http://www.bsyse.wsu.edu/saxton/soilwater/Glossary.htm

The Effects of Land Use on Soils

http://www.cprl.ars.usda.gov/wmru/pdfs/ISTRO2000.pdf
http://clic.cses.vt.edu/icomanth/17-AS_PA_Study.pdf
http://www.bsrsi.msu.edu/overview/effects.html
http://ohioline.osu.edu/fm-news/sp02/sp02.pdf

Conservation Planning/Nonpoint Source Pollution
http://topomaps.usgs.gov/
http://www.topozone.com/map.asp?lat=30.08722&lon=-91.90528
http://www.epa.gov/owow/nps/facts/point6.htm
http://www.epa.gov/owow/nps/facts/
http://www.cwp.org/
http://www.piercecountycd.org/conserve.htm
http://policy.nrcs.usda.gov/scripts/lpsiis.dll/M/M_440_505.htm

Types of Erosion and Reduction Methods
Soil Survey
http://www.wvu.edu/~agexten/forestry/bestprac.htm
http://www.lsuagcenter.com/subjects/masterfarmer/bmp.asp
http://soils.ecn.purdue.edu/~wepphtml/wepp/wepptut/jhtml/wtrersn.html
http://www.constr.com/tx/terms.htm
http://www.cwp.org/esc_practices.htm
http://abe.www.ecn.purdue.edu/~agen521/epadir/erosion/types_erosion.html
http://www.kn.pacbell.com/wired/fil/pages/listerosionas.html
http://ceed.wsu.edu/watersheds/Watershed_Education/erosion.htm
http://www.ipm.iastate.edu/ipm/icm/2000/7-24-2000/erosion.html
ftp://ftp-fc.sc.egov.usda.gov/NJ/technical_resources/soils/surfacedown.pdf
http://www.itc.nl/~rossiter/research/rsrch_ss.html

Urban soils
http://soils.usda.gov/sqi/files/u03d.pdf
http://soils.usda.gov/sqi/files/u02d.pdf
http://soils.usda.gov/sqi/files/u01d.pdf
http://soils.usda.gov/use/urban/
http://www.urbanforestrysouth.org/pubs/ufmanual/soils/